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ABSTRACT

This report presents highlights of the research activities of the Australian Council for Educational Research (ACER). The ACER is a national independent research body that specializes in collecting and interpreting information to shape strategic decision making. In addition to being a national center for educational policy research and advice, ACER designs and manages large-scale assessment projects and developes a range of professional resources for practitioners in Austraia and other countries. The projects highlighted in this report are: (1) a study of civic education involving 90,000 students in 28 countries, including Australia; (2) a study of educational reform in Indonesia; (3) development of an assessment of general attributes and skills for college entrance in Australia; (4) initiatives on using student achievement data to improve learning; (5) development of online student assessment resources; (6) development of professional standards for teachers of science; (7) research on numeracy and "at risk" students; (8) developing lifelong learning in secondary schools; and (9) the application of ACER expertise to driving tests. (SLD)

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Research Highlights

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2002
Australian Council for Educational Research
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www.acer.edu.au

Australian Council for Educational Research

The Australian Council for Educational Research (ACER) provides state-of-the-art educational research, tools and services

Established in 1930 as Australia's leading independent educational research organisation, ACER has a long history and solid reputation as a provider of reliable support to education policy makers and professional practitioners.

Today, ACER is one of the world's leading education research centres, committed to creating and distributing research-based knowledge, products and services to improve learning across the lifespan in both formal and informal settings.

What we do

ACER is a leader in the provision of quality research, both within Australia and internationally.

As a national, independent research body, we bring a high level of expertise and objectivity to our work.

Blending solid experience and creative talent with established methodologies, ACER is a full-service research consultancy specialising in collecting and interpreting information to shape strategic decision making.

One of our greatest strengths is our people. Our researchers bring many years of experience to their projects, and skills in a range of disciplines and research methods.

In addition to being a national centre for educational policy research and advice, ACER designs and manages large-scale assessment projects and develops a range of professional resources for practitioners.

Assessment services

ACER provides secure, fee for service testing programs to schools, universities, employers and professional organisations.

These programs include selection tests for entry to schools and universities, scholarship tests, and tests for diagnostic and monitoring purposes.

Library resources

ACER's Cunningham Library provides educators with access to more than 50 000 books, 400 professional journals, and numerous conference papers and reports. The library also offers a variety of online information services, including library catalogues, electronic databases, literature searches and document delivery services.

Publications

ACER publishes and sells an extensive range of professional resources such as tests, kits, books and software to practitioners in education, psychology, parent education and human resources.

'Creating and disseminating research-based knowledge and tools to improve learning.'

Our capabilities

ACER offers all the services you would expect to find in a leading educational research organisation.

Policy research

Research is a crucial element of informed decision making. Our research projects investigate topics of importance to education and training, and play a major role in shaping education policy.

Educational measurement

Our educational measurement work covers all areas of the curriculum and all sectors of education. ACER activities include test development, test administration, data coding, data analysis and the development of candidate, group and system reports.

Teaching and learning

ACER has an interest in the development of teachers as professionals and in the relationship between teacher learning and improved student learning. Our current work includes an investigation of the role of professional standards in improving teacher practice.

Large-scale survey research

ACER has an established reputation in large-scale survey research. Our current activities include the OECD Programme for International Student Assessment (PISA) and work for the Third International Mathematics and Science Study (TIMSS).

Longitudinal surveys

ACER also has considerable experience in the conduct of longitudinal surveys. Since the 1970s, the Longitudinal Surveys of Australian Youth have followed the progress of young Australians to provide a better understanding of transitions between school, post-secondary education and work.

Our international work

ACER works in an increasingly international context.

ACER has provided professional development programs in educational assessment and evaluation to ministries of education throughout the Asia-Pacific, and through projects funded by agencies such as AusAID and the World Bank, we are working to support educational reform and development in a number of countries.

International achievement studies

In addition to managing the OECD-PISA project to assess the mathematical, scientific and reading literacy skills of 15-year-olds in about 50 countries, ACER has been responsible for the Australian component of studies conducted by the International Association for the Evaluation of Educational Achievement (IEA). These studies have included the Third International Mathematics and Science Study (TIMSS) and associated follow-up research, and the Civic Education Study.

Aid-funded projects

In collaboration with IDP Education Australia, ACER has undertaken an AusAID-funded development and training project to improve the secondary school examination system in Cambodia.

We have also completed a project to analyse baseline census data on primary schools and teachers in Vietnam.

And in a project funded by the World Bank and Japanese Government, we have provided advice and training in the Philippines on student achievement testing and teacher-based assessment strategies.

With increased world-wide demand for educational research, ACER is well-placed to provide leading-edge capabilities to improve learning – at home, in school, in tertiary education institutions and within the workplace.

Room for improvement in civic education

What do young people in Australia know and believe about democracy compared to their peers around the world? Do they understand how democratic institutions work? Do they expect to vote and take part in other civic activities as adults?

Answers to these questions were revealed in a five-year cross-national research project involving a total of 90 000 students from 28 countries, including Australia.

The study found that of 28 countries involved in the test of civic knowledge, Australia was placed eleventh, in the 'average achievement group' with Hungary, Slovenia, Denmark, Germany, Russian Federation, England, Sweden, Switzerland and Bulgaria. Australia was placed behind Poland, Finland, Cyprus, Greece, Hong Kong, USA, Italy, Slovak Republic, Norway and Czech Republic, which were in the 'above average achievement group'.

Australia's involvement in the International Association for the Evaluation of Educational Achievement (IEA) Civic Education Study was funded by the Commonwealth Government, and the Australian component of the project was undertaken jointly by ACER and the University of Canberra. The study surveyed over 3300 students and 352 teachers in 142 schools throughout Australia in 1999. The international report was released in March 2001, and the Australian national report in March 2002.

Students in most countries had an understanding of fundamental democratic values and institutions – but depth of understanding was a problem. Results revealed that 75 per cent of Australian students recognised the importance of having more than one political party. The rate was similar for students elsewhere in the world. Australian students demonstrated a strong commitment to democracy, but they had difficulty with questions about the forms and purposes of democracy; only half of those surveyed had a grasp of the essential pre-conditions for a properly working democracy.

Photos supplied by the Australian Electoral Commission. Photographer: Arthur Mostead.

Young people throughout the world agreed that good citizenship includes the obligation to vote. In Australia, 89 per cent thought it important that citizens vote, and 85 per cent expected to vote as adults. Only 55 per cent believed they learn about the importance of voting in school.

The project director of the Australian component of the study, ACER Research Fellow, Ms Suzanne Mellor, said that aside from voting, the report found that students are sceptical about traditional forms of political engagement.

'Australian students, like those internationally, do not intend to participate in conventional political activity, other than voting. Eighty-nine per cent do not expect to join a political party, 76 per cent do not expect to write letters to newspapers about social or political concerns, and 87 per cent do not expect to be a candidate for a local or city office,' Ms Mellor said.

'However, Australian students indicated they were prepared to be involved in civic life, with 62 per cent saying they would collect money for a social cause. More than three quarters believed students could make a positive contribution when they participate in school governance, but only one third of them had done so.'

Students in the international study were drawn to television as their source of news. Television news was the preferred source of information for 80 per cent of Australian students, though about two-thirds of them also read about what was happening in this country and in other countries in the newspapers, and 62 per cent listened to radio news. Watching television frequently was associated with higher civic knowledge. In Australia, this had a greater effect than for students internationally.

Students around the world were supportive of the political rights of women and of immigrants. In Australia, 90 per cent of students agreed that women should have the same rights as men, and 93 per cent agreed that women should be entitled to equal pay for the same job. In all countries females demonstrated much more support than males for women's rights.

All educators in Australia should familiarise themselves with the report, according to Professor Geoff Masters, Chief Executive Officer of ACER.

'Schools can help to build more civic-minded students by paying attention to this area of the curriculum and by generating diverse co-curricula activities for students,' Professor Masters said.

Almost all teachers (98 per cent) believed that 'teaching civic education makes a difference for students' political and civic development' and that 'it matters a great deal for our country'. While only a quarter of the teachers surveyed had initial training in civic education, almost three quarters of them had since undertaken professional development in this area. They indicated that training and curriculum materials are needed to support civic education learning.

'In Australia, civic knowledge was lower than the international average, and civic engagement was also down. But the study's results suggest that student participation in school governance – for example by being a member of a school council – helps build students' confidence in the value of participation and is correlated with their civic knowledge and likelihood of voting.'

Professor Masters recommended that policy makers, teachers, parents and students continue to examine the role of civic education in the school curriculum to ensure that Australia's citizens of the future are well prepared for their role in a democratic society.

Further information

Torney-Purta, J., Lehmann, R., Oswald, H. and Schulz, W. (2001). *Citizenship and Education in Twenty-Eight Countries: Civic Knowledge and Engagement at Age Fourteen.* Amsterdam: IEA 2001. (available from www.iea.nl)

Mellor, S., Kennedy, K. & Greenwood, L. (2002). *Citizenship and Democracy: Students' Knowledge and Beliefs, Australian Fourteen Year Olds and the IEA Civic Education Study.* (available from www.acer.edu.au)

Reform of Indonesia's education system

ACER is playing a part in helping Indonesia achieve its education goals

Most Australians are well aware of the recent momentous political and social changes in Indonesia. However, few would know that our northern neighbour is also currently engaged in major educational reform. These changes are likely to have far reaching effects on Indonesia's social, cultural and economic future.

Through the Commonwealth Department of Education, Science and Training, ACER and the Curriculum Corporation were contracted to support the Indonesian Institute of Research and Development (BALITBANG) in curriculum and assessment reform.

Although there have been a number of educational reforms since Indonesia gained independence in the late 1940s, the education system has remained highly centralised and the curriculum has been dominated by rote learning and memorisation. One of Indonesia's national priorities is to develop a curriculum appropriate to a global and democratic society.

'It's exciting to be involved in a process that potentially could have such a big effect on so many people's lives.'

The proposed education reform will involve: developing a national competency-based curriculum and assessment framework designed both to maintain unity and to allow for diversity; developing systems of public accountability and quality assurance that will increase public satisfaction with education; and decentralising aspects of management in order to make the best use of resources.

In terms of curricular change, this means local districts are being encouraged to interpret the nationally mandated competency-based curriculum in locally relevant ways – much like the way in which, in Australia, a system-level outcomes or standards framework is interpreted via learning programs devised at the school level.

ACER's Project Director, Ms Juliette Mendelovits said 'The curriculum has been crowded with many subjects and students are predominantly engaged in memorising many discrete pieces of information.

'The curriculum and assessment reforms now being envisaged are directed at active learning, fostering students' abilities to develop deep understandings, to think independently and critically, and to solve problems. Another crucial plank of the reforms is to allow regional diversity within syllabuses, while maintaining national standards and priorities.'

The national examinations at the end of primary, junior secondary and senior secondary school (Ebtanas examinations) have been in the form of multiple-choice tests constructed in ways that can encourage rote learning.

As a first step, the Year 6 Ebtanas has recently been abolished, to be replaced with school-based assessments. The intention is that the style of assessment will change from its current focus on memorisation to include more interpretive and reflective tasks.

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Implementing the reforms

The new competency-based curriculum, which has been developed over several years by the curriculum section of BALITBANG, is being implemented in stages over three years. The full implementation of the competency-based curriculum will be in place by the middle of 2005.

With such a large vastly-spread diverse population, implementing reform in Indonesia is a complex process demanding of professional and material resources. The basic methodology being adopted for curriculum reform is a cascade model, in which members of a small group of professionals are trained to become trainers and leaders in their own right. They in turn then provide training to larger groups of professionals, and so on.

Initially, twenty-seven schools from three provinces of Java are participating in a mini-pilot of the draft curriculum through training workshops. The content of these workshops will be reinforced through a pair of short manuals on implementing strategies for competency-based learning, and classroom-based assessment methods.

'It is clear that many of the ideas we presented at the workshop were quite new to the teachers and that further elaboration and reinforcement of the practices will be needed,' said Ms Mendelovits.

'But, judging by our reception, teachers are very interested and there is a real appetite for change. And for us, it's exciting to be involved in a process that potentially could have such a big effect on so many people's lives.'

ACER and Curriculum Corporation have assisted BALITBANG in developing a framework for curriculum and assessment reform as the basis for public discussion. Their role also involved planning, implementation and evaluation of the first year of the mini-pilot of the curriculum in Java, with an emphasis on the provision of professional support and development for teachers. ACER prepared a manual for teachers on classroom-based assessment reflecting the competency-based curriculum, which BALITBANG plans to translate and disseminate.

A school in Jogjakarta. *Photo courtesy of Joan Holt, Curriculum Corporation.*

ACER is also advising BALITBANG Examinations centre staff on national strategies for both system-level monitoring and national assessments.

This project builds on ACER's work with the Indonesian education system. Over the last few years, a number of BALITBANG's staff have received training in Melbourne. ACER's Director of International Development, Mr Peter McGuckian, also worked with BALITBANG staff to develop a joint cooperation agreement that provided an institution-to-institution framework for the project.

Although this AusAid-funded project was completed in 2002, the working relationships established between Australian and Indonesian educational researchers will continue.

Working with universities to enhance selection

An ACER test to assess general skills and personal qualities is used in the selection process for students in the health professions

Concerns about selecting students for high prestige professional courses in medicine and other health sciences on the basis of Equivalent National Tertiary Entrance Rank (ENTER) alone have led to the widespread introduction of selection procedures that include interviews and assessment of skills in problem solving and general reasoning as well as personal qualities.

There are usually far more academically qualified applicants than there are places in professional degree programs. Until recently, selection into medicine and health science courses was often based entirely on academic criteria, requiring a very high school leaving score based on studies in maths and science.

However, there is now widespread agreement that other qualities are also important in our future doctors and health science graduates. The community now demands health professionals who have a demonstrated ability to communicate with and relate to their patients, in addition to having highly developed levels of skill within their field.

Most universities now use a range of methods to select these students, including interviews and entrance tests. ACER plays a significant role in assisting Australian universities in their selection of appropriate applicants for entry to medical and other health science degrees.

The Undergraduate Medicine and Health Sciences Admission Test (UMAT), first developed by ACER for the University of Newcastle 12 years ago, is now widely used by Australian universities to select undergraduate students for medical, dental and physiotherapy courses. UMAT is currently used for admission to undergraduate medicine at Adelaide University, Monash University, the University of Melbourne, the University of Newcastle, the University of New South Wales, the University of Queensland, the University of Western Australia and the University of Tasmania. In addition, it is used for admission to dentistry at Adelaide University, the University of Melbourne and the University of Western Australia; and for admission to physiotherapy at the University of Melbourne. In 2003 the University of Otago in New Zealand will use UMAT in the selection of medical students.

Another test developed by ACER, the Graduate Australian Medical School Admissions Test (GAMSAT), is used to select graduates for entry into four-year medical degree programs at Flinders University, the University of Melbourne (4½ years), the University of Queensland, and the University of Sydney, with the new Australian National University medical school joining in 2003.

ACER has a central role in the UMAT program – developing the test and associated

Selection procedures should achieve several outcomes, including 'good' doctors, which, while difficult to define precisely, encompasses people who not only have a high level of clinical competence but who also have personal attributes and attitudes pertinent to good medical practice.

Doherty, R.L., Amos, B., Hicks, N., Larkins, R., Morey, S., Sargeant, D. & Smith, R. (1998) Australian Medical Education and Workforce into the 21st Century. Canberra: AGPS.

information, processing registrations, scoring and analysing the test, reporting results to universities and candidates, and taking responsibility for the overall administration and integrity of UMAT. ACER also works closely with the consortium of UMAT universities to further develop the program.

UMAT is not curriculum based and presupposes no particular subjects of study at secondary school level. The test aims to assess a range of general skills and abilities.

'These general skills are not directly revealed through academic testing, but they are considered important to the study and practice of professions in the health sciences,' says Ms Cecily Aldous, the UMAT Manager at ACER.

'ACER is developing expertise in testing abilities that are not based around particular curriculum areas,' Ms Aldous says.

The test

UMAT is designed to assess general attributes and skills gained through prior experience and learning. In particular, it assesses the acquisition of skills in critical thinking and problem solving, interactions with others and abstract, non-verbal reasoning.

The multiple-choice test takes two hours to complete, and is divided into three sections:

Logical reasoning and problem solving

Logical reasoning questions assess the ability to comprehend a passage or piece of information and to draw logical conclusions. Problem solving questions test the ability to reach solutions by identifying relevant facts, evaluating information, pinpointing additional or missing information, and generating and testing plausible hypotheses.

Interaction skills

In this part of the test, short conversational scenarios are presented, some of which are between a health professional and a patient, while others focus on more general interactions between individuals. Based on the situation posed, candidates select the response or course of action they consider most appropriate from four options.

Non-verbal reasoning

The ability to extract information from a large amount of irrelevant data is tested in this section, through questions involving complex patterns and shapes.

'Early research indicates that the new selection procedures, of which UMAT is a part, in combination with curriculum change, are having a positive impact on student outcomes. Some universities comment that students seem to enjoy their course more too,' Ms Aldous said.

'It is something that will be systematically monitored over the coming years.'

Approximately 8000 Year 12 and mature age candidates take UMAT each year. The test is held once annually throughout Australia, in New Zealand and London.

Further information

Further information about the test can be found at www.acer.edu.au/unitest/umat or by telephoning (03) 9277 5673. Email: umat@acer.edu.au

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Using student achievement data to improve learning

Good decision making at all levels of an education system is facilitated by easily accessible, relevant and reliable information

Many indicators provide useful input to educational decision making; but the most important indicators are those which address the central concern of education: the promotion of student learning.

Ms Margaret Forster, director of ACER's research program in assessment and reporting says, 'Education systems monitor student learning – with the fundamental intention of promoting learning – by collecting, analysing and reporting student achievement data. Given that state, national and international achievement studies are both time consuming and expensive, it seems prudent to reflect on this effort.'

Issues that should be considered include the purpose of these programs, how data are reported and used, and ensuring that data will provide evidence for informed decision making.

'Education systems monitor student learning – with the fundamental intention of promoting learning – by collecting, analysing and reporting student achievement data.'

Collecting and using the data

Teachers collect information about what students know, understand, can do and value from a range of sources. These sources include observations of students as they work in the classroom, structured teacher-developed assessment tasks, commercially developed diagnostic instruments, assessments provided by systemwide assessment programs, and tasks delivered as part of international assessment studies. The information collected is used at different levels of the education system for a range of purposes, but with the ultimate aim of improving student learning.

At classroom level, student achievement data is used to feed directly into the teaching and learning cycle, and to provide information to students, parents, and other teachers.

The information is used at school department level for screening and selection purposes and curriculum feedback; and at whole school level for curriculum planning, resource allocation, staff development, and school restructuring.

At school system level, student achievement data is useful for monitoring purposes, resource allocation, and benchmarking and accountability purposes. 'The management of an education system is a complex and expensive operation. If decisions are to be informed, then dependable information on educational outputs is required. Systemwide programs provide this information for system level monitoring and resource allocation,' Ms Forster said.

At a national level, international studies provide a broader view of how an education system compares to those in other countries.

'In international studies, the world is viewed as a global educational laboratory where different national policies and practices yield different educational outcomes. The underlying assumption is that differences in student

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performance between countries can be linked to characteristics of particular education systems. However, these characteristics need to be understood in their broader cultural and economic contexts,' Ms Forster said.

Designing assessment systems for student learning

Over recent decades, a great deal has been learned about the ways in which large-scale assessment programs impact on practice, and about the unforeseen and unintended consequences of particular approaches to assessment.

'For example, we know that the introduction of minimum competency tests in the US in the 1970s and 1980s led teachers to focus their teaching efforts on the foundational skills assessed by these tests and to concentrate their attention on students who had not yet achieved these skills. This was sometimes at the expense of extending the knowledge and skills of higher achieving students – an unintended and undesirable consequence of the testing program. The challenge for policy makers is to learn from past programs and to ensure that each decision made in designing an assessment system ultimately facilitates student learning,' Ms Forster said.

ACER has published two guides on the use of student achievement data in education systems: *A Policy Maker's Guide to International Achievement Studies* and *A Policy Maker's Guide to Systemwide Assessment Programs*. Both guides include a checklist of considerations to ensure that student achievement data provides evidence for informed decision-making that will lead to improved student learning. The checklists include information about ensuring the aims of the study are clear, collection and reporting of data, monitoring trends and accountability. The reviews were undertaken as part of a program funded by a grant from the states and territories and the Commonwealth. Future guides will focus on whole school use of student achievement data to improve learning, and teacher use of data within the classroom.

'At the end of the program,' says Ms Forster, 'we should have a comprehensive picture of the ways in which student achievement data are used at all levels of the education system. The challenge then will be to draw research-based conclusions about the best ways to coordinate our efforts across the different levels of the system in order to use data efficiently and effectively to improve student learning outcomes.'

Further information

Forster, M. (2000). *A Policy Maker's Guide to International Achievement Studies*. Melbourne: ACER. (available from ACER Press or from www.acer.edu.au)

Forster, M. (2001). *A Policy Maker's Guide to Systemwide Assessment Programs*. Melbourne: ACER. (available from ACER Press or from www.acer.edu.au)

Online school assessment resources

The range of online resources for schools now includes a resource for assessing school outcomes and monitoring student progress

With the growth of the Internet, schools have online access to an expanding range of resources for use in school management. An addition to this range provides schools with high-quality materials for monitoring students' literacy and numeracy learning.

ACER's new school assessment service, *iAchieve*, aims to assist schools to integrate the use of authentic assessments into their curriculum programs, providing a range of descriptive and diagnostic reports of student outcomes for teachers, students and parents.

iAchieve assessments can be used as pre- and post-tests to assess development over time. A range of Reading, Writing, Number and Chance and Data assessments and screening tests are available. *iAchieve* provides schools with advice as to the most appropriate use of these assessments at each year level from year 3 through year 8.

Over the next year it is anticipated that the range of assessments available to schools will increase substantially, including a questionnaire of student attitudes and perceptions of a variety of issues relating to school life. Results of these assessments and questionnaires can then be used with benchmark data to inform school improvement programs.

An attractive feature of *iAchieve* is its simple format and user-friendly interface. Another is the ease with which schools can manage student tests and results online.

Upon registration, schools receive an *iAchieve* school administration password which allows them to control who completes assessments, when the assessments are to be completed, and who receives the individual student, class, year level or school reports.

Data collected through *iAchieve* are recorded at the individual level, and individual and summary reports are provided to the school. Responses to the questionnaire about school life will also be anonymous and will be reported in a summary table.

Schools may choose to have ACER mark student responses, providing an independent external audit. ACER manages quality assurance processes for *iAchieve* assessments and questionnaires. *iAchieve* maintains full confidentiality and does not make data available to any other party without permission of the school.

Flexibility for teachers

Ms Wendy Bodey, one of the key staff from ACER involved in the development of *iAchieve*, points out that online assessments allow teachers greater flexibility in administering, marking and checking student work.

iAchieve
Number Zoo 6
Question
Question: 7
Look at this picture of a seal being fed in the main seals' pool.
There are 478,926 litres of water in the seals' main pool. This water goes through a filter at the rate of 50 litres per second.
How long does it take for all the water in the pool to go through the filter? Round your answer to the nearest second.
All the water is filtered every
seconds.
Next Question

'The system caters well for small or large numbers of students. A teacher is able to organise for an individual, a small group of students or the whole class to complete an assessment or questionnaire', she said.

'Once students' answers to a question have been marked, they can be sorted by score, allowing teachers to check their marking consistency. This sort of checking is much more time consuming in paper and pen assessments.'

Benefits for schools

iAchieve began operating in March 2001 in more than 30 pilot schools. The *iAchieve* Project Director, Ms Adele Butler, describes the feedback from schools currently using the system as very encouraging.

'Schools have been very positive about the benefits of the service and the appropriateness of the user interface.

'Students enjoy the online system and find it easy to use. Schools appreciate the range of assessments and the flexibility to control, at the school level, who completes the assessments and who receives the reports.

'*iAchieve* provides individual reports which describe a student's estimated level of achievement in terms of the skills and understandings typically displayed at that level. A diagnostic report is available allowing teachers to explore in detail how a student has performed on particular assessment tasks.

'These tools will be valuable for schools in monitoring and improving students' learning and also school programs', Ms Butler said.

Further information

For further information visit the *iAchieve* web site at www.iachieve.com.au, phone Ms Adele Butler on (03) 9277 5755 or email info@iachieve.com.au.

'Students enjoy the online system and find it easy to use... These tools will be valuable for schools in monitoring and improving students' learning and also school programs.'

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Professional standards for teachers of science

High teaching standards are vital for quality education. But what makes a good teacher, and how can that be measured?

Teaching standards articulate core educational values and describe what teachers need to know and be able to do to put these values into practice.

ACER's Head of Teaching and Learning Division, Dr Lawrence Ingvarson, said 'What teachers know and do is the most important factor affecting student learning outcomes. Nothing matters more to the quality of education in our schools than the knowledge, skill and commitment of teachers.'

'We need strategies to attract able graduates, prepare them well, retain them in teaching and promote their continuing professional development toward high professional standards. Central to the success of such strategies are improved working conditions and career paths that place greater value on teachers' work and provide greater incentives for all teachers to develop toward high levels of effectiveness.'

In any profession, standards are important for registration, accreditation and certification.

'The chance to see myself teach and reflect upon my practice, although daunting, enabled me to look closely at the things I did well as well as look at the things I could improve on.'

Teacher who participated in the portfolios trial

'Professional standards, by definition, are profession wide, and registration and certification, as endorsements that practitioners have attained those standards, are portable qualifications. This could be useful for teachers as they move between sectors and employers,' Dr Ingvarson said.

Standards for teachers of science

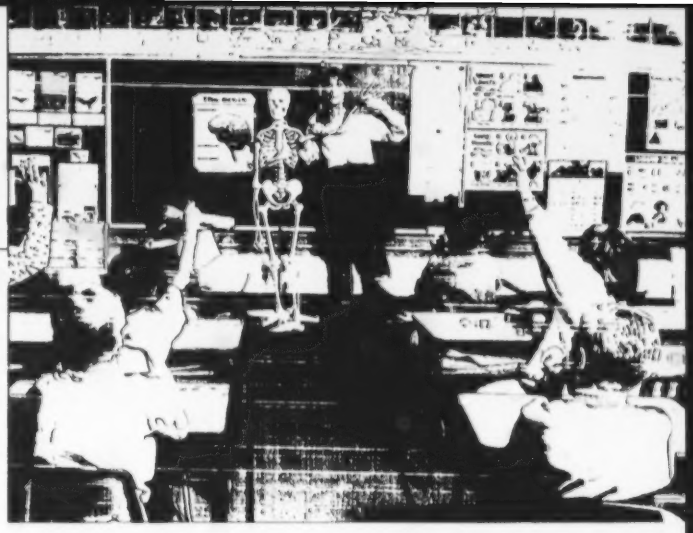
The Australian Science Teachers Association (ASTA) launched the National Professional Standards for Highly Accomplished Teachers of Science in March 2002.

The project was conducted by Monash University as an Australian Research Council Strategic Partnerships with Industry – Research and Training project in collaboration with ASTA. Dr Ingvarson was the project's Chief Investigator. These standards and methods for assessing performance of science teachers provide a basis for:

- improving the effectiveness of professional development;
- improving career paths and pay systems for teachers who attain the standards;
- incentives for teachers to engage in long term professional learning; and
- strengthening the contribution the profession makes to leadership in teaching, accountability and quality assurance.

Once the standards were established, tasks for assessing the performance of highly accomplished teachers of science for professional certification were developed. Groups of teachers in four states were involved in trialing and evaluating the potential of five different portfolio entries as a way in which teachers can present evidence about their practice.

The structured portfolios cover core tasks that teachers perform in the normal course of their work. The portfolio entries collectively provide reliable evidence through multiple



sources of a teacher's performance that can be measured against the standards. The portfolio entries are based on analysing student work samples, videotapes of teaching and accomplishments outside the classroom. Integral to all portfolios is the written commentary in which teachers critically analyse their practice and reflect on implications for future teaching and learning of their students.

Relating professional standards to practice

ACER has developed a professional development program, *Relating professional standards to practice*, designed to assist groups of teachers of science to use teaching standards to reflect on their practice and help them to analyse evidence from students' work and videotapes of classroom interactions.

'For the teachers who participated in the program, and for the facilitators too, the experience has been enriching and rewarding. They have a strong conviction, supported by evidence, that their teaching practice has already changed for the better,' Dr Ingvarson said.

Six schools are participating in a trial of the professional development program, which will cover six sessions over one year. The teachers will evaluate the impact of this portfolio preparation on their professional learning.

'The next step – the certification of science teachers – will be available in the next few years.'

Assessment of teacher performance, using the evidence provided by the portfolios, will provide the basis for a voluntary system of professional certification.

Professional certification

'We need tools that will build strong links between standards and action; otherwise standards will remain on the shelf. Assessment is an essential tool in building these links,' Dr Ingvarson said. 'The hard question is how we move from where we are to a profession that actually has some real responsibilities, such as certification, with which it is entrusted.'

Initially, not all education authorities will want to become involved with professional certification or accreditation, according to Dr Ingvarson. 'Some states and territories appear ready to move in this direction, others have their own schemes. In fact it may be wiser to start with just one or two states and territories and build out from there.

'It is increasingly common to hear senior government officials say that the development of teaching standards is not their business; rather it is something they are looking for the profession to do. There are now many more signs that this is just what the profession is willing and able to do.'

Further information

Australian Science Teachers Association. (2002). *National professional standards for highly accomplished teachers of science*. ASTA National Science Standards Committee: Canberra.

Ingvarson, L. (2002). *Development of a National Standards Framework for the Teaching Profession*, An issues paper prepared for the MCEETYA Taskforce on Teacher Quality and Educational Leadership, ACER: Melbourne.

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Improving numeracy learning

Numeracy researchers and educators need to reconsider how they define 'at risk' students

Too many students leave school lacking the skills to exercise 'intelligent practical mathematical action in context', proficiency in numeracy remains socially distributed, and too many educators are unsurprised by the failure of many children to achieve adequate numeracy skills.

These are among the observations made by Professor Sue Willis of Monash University at ACER's Research Conference *Improving Numeracy Learning: What Does the Research Tell Us?*

Researchers were surprised to discover that some children who would typically be described as 'non-counters' were able to say that there were seven pencils or eight rocks.

Professor Willis argued that all students have the right to leave school with high levels of numeracy and that all but a very small proportion of students are capable of doing this. The challenge is to identify students at risk of not achieving high levels of numeracy.

But what does it mean for students to be 'at risk'?

Professor Willis noted that it is common to define 'risk' in terms of students' membership of particular groups. For example, according to the Commonwealth government's Literacy Policy for Schools:

> The major factors which are usually seen as placing educational outcomes at risk include socioeconomic disadvantage, poverty, low parental expectation, disability, language background other than English, family or personal difficulties, geographic isolation, Indigenous background and gender.

Under this view, the curriculum is viewed as 'innocent' and schools and teachers are seen as the solution to the 'problems' of differences between children. Willis argued that assumptions made by curricula that learning should normally proceed in particular ways may disadvantage and put 'at risk' children who learn in different ways.

'Whether or not children are "at risk" relates to whether their long term progress or mathematical growth is at risk, it is not simply a description of their current performance nor is it a description of the social grouping to which they belong,' Professor Willis said.

'We often assume that "risk" is something that children bring with them to school, that it lies out there, with the children's families and communities, or their own personal characteristics.'

'We often assume that "risk" is something that children bring with them to school, that it lies out there, with the children's families and communities, or their own personal characteristics.'

'However, our research shows that sometimes the way we sequence and assess learning in schools may disadvantage some students, and prevent them from making progress,' Professor Willis said.

Professor Willis gave an example from a study commissioned by the Education Department of Western Australia. It is common for mathematics curricula to assume that children who cannot count beyond six in the sense of reciting number names ('one, two, three, four, five, six') will be unable to say how many objects there are in a collection of eight objects or nine objects. But in the Western Australian study, Aboriginal children were encountered who would typically be described as 'non-counters' were able to say that there were seven pencils or eight rocks. They also were able to tell at a glance when one or two items were removed from a scattered collection of eight or nine.

Upon further investigation, they found that some Aboriginal communities involve social activities that may help children recognise 'how many' at a glance. These activities parallel but are different from the counting oriented activities that many majority culture children experience.

Curricula that assume that all children develop numeracy skills in the same way may identify individuals as being 'at risk' because they are less advanced in reciting number names, even though they are more advanced than other children in being able to say how many objects are in a group. In other words, the 'risk' may be less the result of belonging to a particular group and more the result of curricular assumptions.

In a second example, Professor Willis argued that whether or not children are 'at risk' relates to whether their long-term progress or mathematical growth is at risk. Risk may not simply be associated with their current level of achievement.

When presented with the question: *What is 473+398?* two children can produce correct answers, but using different methods.

One child may answer by following rules for lining up the digits and methodically adding columns:

$$\begin{array}{r} 473 \\ +\ 398 \\ \hline 871 \end{array}$$

while a second child may answer using 'intelligent mathematical action':

$$473 + 398 = 471 + 400 = 871$$

Willis argued that these two children, while both producing correct answers, show different degrees of number sense. The failure of teachers to distinguish between these different levels of understanding may put the second child 'at risk' in terms of his or her future progress in mathematics.

Improving numeracy learning depends on identifying children at risk. But our understandings of what it means to be 'at risk' must become more sophisticated than understandings based solely on group membership or students' current abilities to produce correct answers.

Further information

Papers from ACER's research conferences are available on the ACER web site: www.acer.edu.au

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Developing lifelong learning in secondary schools

Today's young people need to be flexible and adaptable to meet the challenges they will face in their lives after school

Young people who are not able to anticipate and adapt to change – to continue learning throughout their lives – are likely to become increasingly marginalised in economic and social life, according to two ACER reports, *The era of lifelong learning: implications for secondary schools* and *Engaging secondary school students in lifelong learning*.

'While schools already give most students skills for life, different elements of learning could be brought together more to build on and reinforce each other,' one of the authors, Ms Jennifer Bryce, said.

'A key change for secondary schools is to immerse their students, to a greater degree than ever before, in the world outside school – particularly the world of work. This will involve not just simple work experiences, as in the past, but giving opportunities for developing and honing personal skills, particularly in information technology, boosting self-esteem and personal confidence, and maximising opportunities for the display of enquiry, enterprise and imagination in the world beyond the school fence.'

'The traditional focus on "learning skills" will be much more effective in lifelong learning terms if designed around personal learning plans linked to settings outside the classroom and oriented towards more applied learning.'

The central role of schools in equipping students with essential attributes and abilities will not change. But 'essential' learning has enlarged in scope far beyond 'basic skills' and previous notions of 'core curriculum'.

Schools need to consider how they can change their practice to become promoters of lifelong learning. 'For most schools this will not require substantial increases in material resources but will require reorientation, particularly in relation to the notion of what it means to be a teacher and what it means to be a student.'

Key areas schools should consider when preparing school leavers with a lifelong learning orientation are:

Becoming 'information literate'

An information literate person recognises when information is needed and then locates, evaluates and uses information effectively.

The knowledge base of the lifelong learner is characterised by its breadth and depth – by an ability to synthesise, analyse and evaluate information.

'Lifelong learning is far broader than the provision of second-chance education and training for adults. It is based on the view that everyone should be able, motivated and actively encouraged to learn throughout life. This view of learning embraces individual and social development of all kinds and in all settings: formally, in schools, vocational, tertiary and adult education institutions; and non-formally, at home, at work and in the community.' OECD 1997

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We are well organised.
We often work together.
We reflect and think about our progress.
Before we start something we think about where our strengths lie.
We are problem-solvers.
We like to adapt new technology to our everyday lives.
We're comfortable about takings risks in class.
We are flexible.
We're good at finding and sorting information.

What could it mean to be a lifelong learner at secondary school?

Values, dispositions and attitudes associated with lifelong learning

Lifelong learners need to face change with confidence, and value change for its possible positive outcomes. They are ready to change personal direction when new and interesting arenas for learning emerge, and are able to predict the kinds of skills and information needed for the new situations they encounter.

Generic skills that promote lifelong learning

Lifelong learners require well developed generic skills in areas such as problem solving and communication.

Developing a strong personal self-concept that assists learning

The development of a positive self-concept or high self-esteem in students is an important educational goal in itself. A positive self-concept can enhance students' motivation, persistence and attitude towards learning, and their achievement.

Helping people learn how to learn

Lifelong learners need to be taught how to use a range of learning strategies which will enable them to achieve their learning goals, including basic cognitive strategies which assist them to remember information and other study skills such as time management.

Promoting lifelong learning

The reports identify how schools, teachers and students can promote lifelong learning.

'Schools can structure the curriculum so it is easy to make connections from one field of study to another, recognise the importance of information literacy skills in all learning areas, establish partnerships with local community groups to support student learning, and encourage assessment policies to recognise student learning that takes place out of school,' Ms Bryce said.

Teachers can use strategies which support young people to take control of their own learning and provide regular feedback to students on their attempts to do this. Professional development may also enhance teachers' understanding of the learning process.

'It is important that teachers are lifelong learners themselves, and that they see themselves as facilitators and mentors, rather than purely as dispensers of knowledge,' Ms Bryce said.

'Students can also develop their own capacity for lifelong learning by making use of the community outside school as a source of knowledge, reflecting on the modes of learning that best suit them and recognising that their teachers are learning as well as teaching,' Ms Bryce said.

Further information

Bryce, J. & Withers, G. (2003). *Engaging secondary school students in lifelong learning*. Melbourne: ACER. (available from www.acer.edu.au)

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Applying ACER expertise to driving tests

Test development know-how is now being put to use in some unexpected places

ACER test developers have assisted in the re-development of a computer-based car driver Learner Permit Test in Victoria. All candidates for a Learner Permit now have to complete the test on the Computerised Licence Testing System at a VicRoads Registration and Licensing Office. The updated computer version of the licence test draws on an expanded pool of over 300 questions.

'Much of our expertise in test development, administration and scoring was directly applicable to the construction of this new test,' says Ms Adele Butler, ACER project manager for the driver licence testing project.

ACER based the content of the test questions on the material in the new VicRoads publication *Road to Solo Driving* which has replaced the *Victorian Traffic Handbook*. ACER test writers were also guided by the novice driver experts from the Monash University Accident Research Centre (MUARC). In the new test VicRoads wanted to incorporate questions that were based on known hazards for new drivers. In 2000, 29 per cent of serious casualties were aged between 18 and 25 years. The close cooperation of MUARC and ACER staff meant that the new questions were well targetted to the intended audience.

Photo courtesy of VicRoads

The test questions, which offer audio as an option to the user, were trialed over the Internet with school students aged 16 to 18 years. ACER staff developed a database that was able to deliver a set of different questions to each student who logged on. As a result, it was possible to have a group of students in the same classroom completing the trial test answering different questions.

Another benefit of using the Internet to trial the questions was that a broad range of schools could participate. Every school in Victoria that had students eligible to receive a car learner permit was invited to participate. More than 5000 individuals from over 170 institutions participated in the trial.

'ACER's expertise in test delivery over the Internet will be a valuable asset in future computer-based testing programs. Geographic location will no longer be a barrier to participation in such trials. Furthermore, the technology allows for a more efficient collation of results,' Ms Butler said.

ACER was also responsible for the design of a self-assessment version and a demonstration version of the learner permit test. It is proposed that the self-assessment version will be available on the Internet from the VicRoads website. Prospective candidates will be able to give themselves dummy tests made up of actual test questions. This online practice test will provide feedback about their performance, and feedback on specific chapters of the *Road to Solo Driving* book.

Further information

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